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AN ALMOST TOTALLY AMBICOLORATE HALIBUT, *HIPPOGLOSSUS HIPPOGLOSSUS*, WITH PARTIALLY ROTATED EYE AND HOOKED DORSAL FIN—THE ONLY RECORDED SPECIMEN

BY E. W. GUDGER AND FRANK E. FIRTH

INTRODUCTION

For the past three years, Gudger has been studying abnormalities—particularly ambicoloration in flatfishes. For this study, Firth (of the U. S. Bureau of Fisheries), from the vantage ground of the Boston Fish Pier, has from time to time enriched the collection of teratological fishes in the American Museum with such specimens.

On the morning of February 14, 1935, Gudger read in the *New York Times* that on the previous day "An all-black halibut was displayed at the Boston Fish Pier . . . the first ever seen there." He hurried to his office to get in touch with Firth, and there found a letter from him giving the essential facts. Further correspondence and considerable personal investigation have enabled us to trace the history of this unique specimen.

HISTORY OF THE SPECIMEN

This teratological halibut was taken on February 4 or 5 by the trawler, *Oretha F. Spinney* of Gloucester, Massachusetts, on the first halibut trip in 1935. It was caught on a line trawl in 200 fathoms of water on St. Peter's Bank east of the northern part of Nova Scotia. The fish was landed on the Boston Fish Pier on February 13, one fish in a catch of 35,000 pounds of halibut made by this vessel. It measured 5 feet 5 inches from tip of snout to fork of the caudal fin, and weighed, without gills and viscera, 55 pounds.

Photographs of the fish were made while it was fresh. Two of these negatives were purchased by the Museum, and two others were presented to the Museum by Firth. These photographs and Firth's notes of the specimen comprise the data from which this article is written. It should be noted here that this is the only black-bellied *Hippoglossus* on record not only in America but also for the world. Hence these photographic negatives are literally unique—the only ones

ever made, not only of an abnormal halibut but of any ambicolorate flatfish with head deformities.

A wholesale fish dealer purchased the halibut on speculation (mainly because it was a curiosity) and displayed it in the window of a retailer in Boston, and later brought it back to his own store. But he found slow sale for it, since there is in Boston a prejudice against such parti-colored flatfish, although in Great Britain such are highly prized. There it is believed that black-bellied flatfish have the muscles of the lower side better developed than those of the normal white-bellied fish and hence that the flesh is firmer and better tasting.

In the meantime the picture of the fish had appeared in the daily papers. The resulting publicity and general interest in this freak gave the owner an exaggerated idea of its value. He wished to sell the fish as a whole, but both Firth and Gudger realized the difficulty of getting so large a fish to the Museum and of preserving it when there. A liberal price was offered for the head, but the dealer refused this and in Firth's absence cut off the head and threw it in the harbor. But in the meantime Firth had secured five separate photographs of the lower side of the fish.

THE NORMAL FISH

In order that the marked abnormalities of our fish may be more readily perceived and understood, we insert here a figure showing the right or upper side of a normal halibut. In this figure, attention is called to three particular structures in the make-up of this, the largest member of the flatfish group: (1) Along the dorsal and ventral edges of the dextral or upper side are certain small whitish blotches. Whatever the cause, these are not abnormalities, since they are generally present and are more readily seen on the larger halibuts. (2) Note the large jaws filled with large strong recurved teeth. These indicate that our fish is an active predator. (3) Particular attention is called to the very high position of the upper, the rotated or left eye. While clear of the dorsal crest, it is very close to this. Furthermore, the anterior termination of the dorsal fin reaches to and often beyond the middle point of this migrated eye. The whole lower surface of this normal fish is of course dead white in color. See Fig. 1.

It should be stated here that at Boston and Gloucester two grades of halibut are distinguished: First, those fish having pure white undersides, which bring the highest price; and second, those having the

under-side of a more or less uniform grayish cast. These bring a lower price. These are called "gray halibut" and are generally the larger fishes. However, the grays are halibut and are recognized by the fishermen as different from the others only in this matter of the faint lower-side coloration. This grayish color has, moreover, nothing to do with ambicoloration.

THE ABNORMAL FISH

Our specimen is the most abnormal fish which Firth has ever seen or handled, and perhaps the most unusual and unique that Gudger has found in three years of study of specimens and literature. It is the largest ambicolorate flatfish on record and the only *Hippoglossus hippoglossus* known to show the marked anomalies now to be considered. However, halibut are sometimes taken having on the under-side spots or patches of the same dark color as that distinguishing the upper-side. These are known to the fishermen as "circus halibut." Our fish was thus denominated by the fishermen at Boston, but all declared that they had never seen one with such a black lower-side nor with such head anomalies.

Color Anomalies.—As Fig. 2 shows, this halibut is nearly dark all over the whole lower surface. On the fins, the basal half of the pectoral is black, and the dorsal and anal are dark save for the white edges and some white in the membrane between the rays. In our best photograph (Fig. 2), the fish is not swung up high enough for the caudal to clear the ground, but other photographs show all the caudal save the hinder third to be very black.

This halibut had been eviscerated and the gills removed when captured, long before the photographs were taken. The hanging of the fish from the head-region has pulled the gill-region of the head away from the anterior end of the ventral part of the body. This area (to the left of the base of the pectoral fin) shows up white in Fig. 2, but this has nothing to do with ambicoloration, since this region (which is normally covered by the gill and throat parts) is normally white. The same remarks apply to the normally gray interior of the mouth as seen.

Interest is now focussed on the head, where the hinder half of the gill-covers, all the lower jaw region and the maxilla of the upper jaw are dark, as is the upper part of the head beneath and to the rear of the rotating eye. For these things see Fig. 2.

Except for the small white regions indicated, the whole under-surface is not only dark but darker than the upper-surface. The posterior third of the under-surface of the body proper and the base of the caudal are darkest, as the figure shows, but even forward of this region the fish is very dark—it is literally a "black belly," as these totally or nearly completely ambicolorate flatfishes are widely known. Let the reader just here compare the appearance of the under-surface of our anomalous specimen with the completely white under-surface of the normal smaller fish held in the fisherman's right hand, as shown in Fig. 2.

Position of Eye.—The position of the partly rotated eye is of especial significance. As may be seen in Fig. 1, in the normal halibut

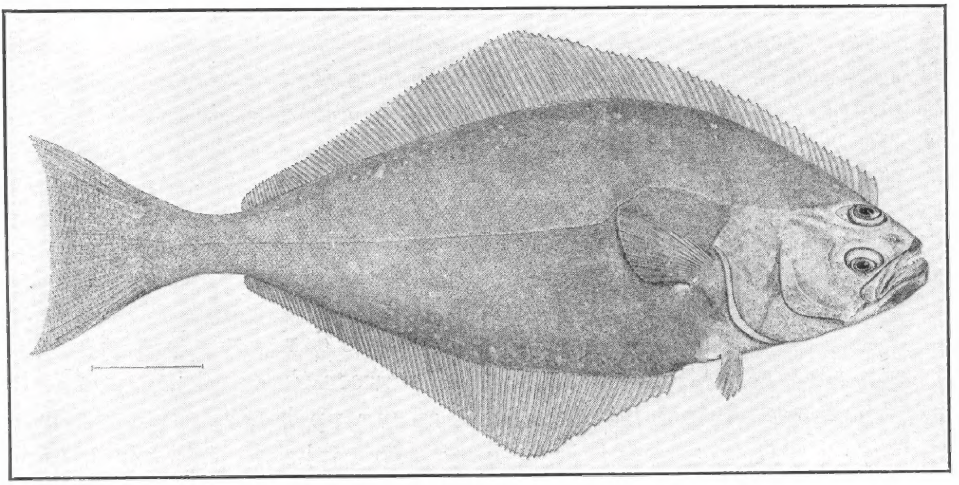

Fig. 1. Upper-surface of a normal halibut, *Hippoglossus hippoglossus*. Note that the rotated eye is placed high on the side of the head, near the dorsal crest but free of it, and that the dorsal fin ends about in line with the middle of the rotated eye. The spots on the dorsal and ventral edges of the body are not abnormalities, as the text explains.

After G. Browne Goode, 1884

the left or rotated eye has migrated from the left side across the dorsal crest. It is clear of this ridge but it is placed high on the right side of the head and very near to the dorsal crest, without, however, interfering with the normal development of the anterior part of the dorsal fin.

As Fig. 2 shows, in the abnormal fish, the left eye has paused in its migration and remains almost on the dorsal ridge. Firth states that

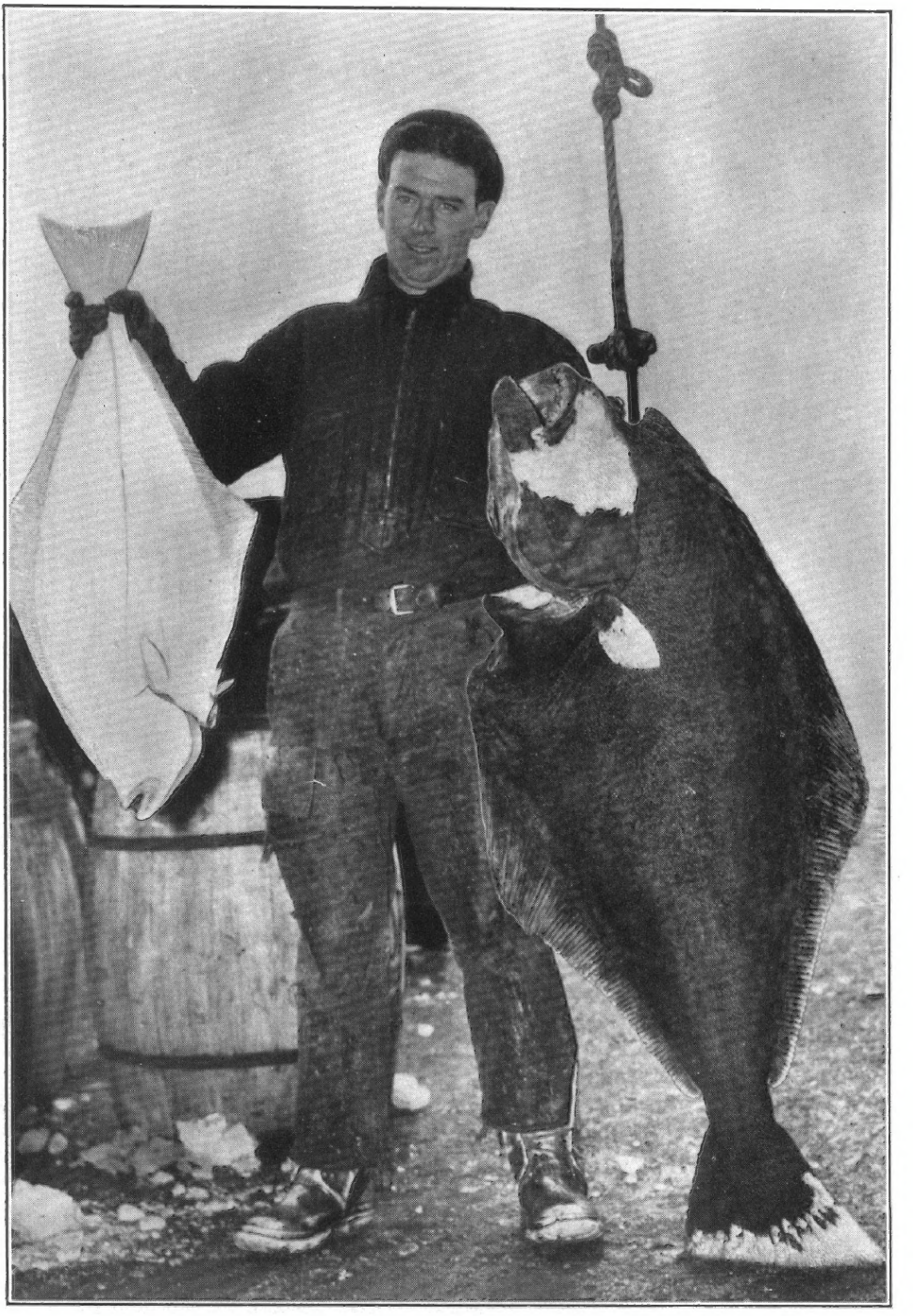

Fig. 2. Ventral surfaces of two halibuts (*Hippoglossus hippoglossus*). The smaller fish has the normal white under-surface. The larger or abnormal fish is nearly completely dark below, has an incompletely rotated eye and a hooked dorsal fin—both of which are absent in the normal fish.

From a photograph

from two thirds to three fourths of the eye had passed over the dorsal crest toward its normal position on the right side, while the remaining fraction rested on the crest. How abnormal this condition is can be realized by comparing the under-side head of the smaller normal fish with that of the larger ambicolorate one. In the normal halibut the left eye has moved clear over the dorsal ridge and is hence invisible, while in our specimen the left eye is still visible from the blind side.

Attention should be called just here to the fact that the rotating eye does not have far to move across the crest to reach its normal position. To see just how small this distance is, note the position of the upper eye in Fig. 1. A very slight retardation in the migration of the left eye will produce the eye condition shown in Fig. 2.

Hooked Dorsal Fin.—The failure of the left eye to move completely over the dorsal crest and its permanent position on the edge of the crest have interfered with the normal forward development and completion of growth of the anterior part of the dorsal fin. Let the reader here note the normal position and origin of the front part of the dorsal as portrayed in the large fish shown in Fig. 1 and in the smaller one in Fig. 2. This retardation of the growth of the dorsal has resulted in the formation of the hook seen in Fig. 2. The formation of such a hooked dorsal is almost invariably associated with the incomplete migration of the eye.

Behavior.—Nothing is known of the habits of black-bellied halibuts. Extreme ambicoloration is known to occur in the smaller (not younger) halibuts and in larger (not older) flounders of the family Pleuronectidae. Since these large fishes have strong jaws and large teeth and are both voracious and predatory, it has been suggested that the markedly ambicolorate forms with their high-placed (cyclopean?) eye swim with the body in normal fish position (dorsal and anal fins in a vertical plane) as the young do until metamorphosis. So far as we know there is no evidence, observational or experimental, for this conclusion. Presumably such fish swim on the side (here left) in normal flatfish fashion.

Other than the statements made above, no effort will be made now to explain the anomalies found in this halibut. The endeavor here is to set out the facts. Gudger, who has been studying these phenomena for some years, has in progress a series of extensive papers reviewing all the literature of these various flatfish anomalies and bringing together all the known data in an endeavor to find explanations.

SUMMARY.—Finally, special attention should be called to the two head abnormalities in conjunction with the relatively large amount of white on the under-surface of our fish. This situation is very unusual.

Gudger has found in one specimen described by him and in an extensive search through the literature that even with the whole under-surface of the body and *less* than half the head dark in color no head abnormalities are to be expected. Furthermore, in cases where most of the head and body are dark in color but where there are considrable white areas scattered over the under-surface, no head abnormalities may be expected.

But in our halibut, the forepart of the head, the spread-out part of the pectoral, the hinder third of the caudal are all white and in addition the dorsal and anal show white fringes. Yet there is found an incompletely rotated eye and a hooked dorsal fin—structures usually associated with extreme ambicoloration. This halibut certainly is one of the most anomalous flatfishes on record.